FEEDING AND GROWTH IN MEROPLANKTONIC LARVAE OF *CALLINECTES SAPIDUS* (CRUSTACEA: PORTUNIDAE)

Capture of sufficient numbers of quality prey to meet the demands of metabolism and growth is a major factor in determining larval survival and recruitment success. Capture of prey is a function of prey density, predator and prey swimming speeds, and handling time. Handling time is related to prey type, size, and natural defences. Feeding rates were determined for the larval stages of the portunid crab, *Callinectes sapidus*, using laboratory and natural prey. Feeding was examined in both light and dark. Using laboratory determined values for energy efficiencies the proportion of daily standard metabolism and growth was determined.

Materials and Methods

Ovigerous *C. sapidus* were collected from the Chesapeake Bay. Upon hatching, the zoea were raised in 1000 ml culture bowls and fed with a diet of 15 000 *Branchionus plicatus*/L and 5000 *Artemia salina*/L. The zoea were transferred into fresh seawater and fed daily.

Prey were counted and placed into 500 ml bottles containing 200 ml of seawater with three replicates of each concentration of prey. A single replicate, without a zoea was used as a control. Prey included *A. salina*, (5, 25, 50, 100/L), *B.plicatus* (25, 50, 125, 250/L), and *Acartia tonsa* (25, 50, 125/L). Zoea of the appropriate stage were added and the bottles incubated at 25°C. After 10–12 hours illumination each zoea was transferred to a new bottle with the same concentrations of prey and incubated at 25°C in the dark. After each segment of the experiment the contents of each bottle were preserved and the remaining prey enumerated.

Wild *C. sapidus* megalopae were collected from plankton samples onboard the NOAA R/V Albatross IV. Prey items were sorted from additional plankton samples and identified to species and developmental stages. Shipboard feeding studies range in duration from 7–9 hours.

Feeding Experiments

When fed a combination of rotifers and *Artemia* nauplii, first and second stage larvae fed exclusively on rotifers. Visual observations suggest that the size of *Artemia* nauplii was the selection criteria. Ingestion of rotifers increased at the second stage and remained relatively stable through the megalopae stage. Third stage zoea occasionally captured *Artemia* nauplii, there was a significant increase in ingestion rates of *Artemia* by the fourth through sixth stage zoeae. A second increase during the last zoeal and the megalopa stage was also evident. Total carbon ingested was low through zoeal stage 3 then increased in parallel with the increase in ingestion of *Artemia* nauplii. Our original hypothesis was that small prey would be dropped from the diet or be captured in reduced number by late stage larvae due to handling costs. These data indicate that small prey contribute to the energetics of all stages. Consumption of *A. tonsa* nauplii was sufficient to meet 25–100% of energy needs for zoeal stages 1–6, but less than 50% of the needs of megalopae (Table 1).

TABLE 1. Daily ingestion of *Acartia tonsa* Stage 1 nauplii by *C. sapidus* larvae.

	STAGE						
CONC L	1	2	4	5	6	7	Meg
25	3.3	4.9	3.8[1]	3.2[2]	5.[illegible]	[illegible]	[illegible]
50	5.3	6.3	8.5	4.6[2]	[illegible]	[illegible]	[illegible]
125	11.[illegible]	14.0	19.6	8.6[3]	28.6	36.2	[illegible]

%Std Metabolism
1 — 50% < Std > 100%; 2 — 25% > Std > 50%; 3 — Std < 25% all others > 100% Std.

Wild megalopae fed the sixth copepodite stage of *Acartia tonsa* demonstrated a linear increase in feeding with concentration. In contrast, consumption of male and female *Centropages hameatus* displayed a sharp plateau at 25/L. Consumption of *C. hameatus* nauplii (I, II) plateaued at 50 to 100/L. Megalopae fed cladocerns, *Penilla* and *Evadne*, displayed a linear increase in feeding through the highest concentrations tested (100/L). Consumption of *Uca* sp. zoea plateaued at 25/L. The observed feeding rates are undoubtedly a function of prey size, handling time, and satiation. Based on the model of Gerritsen and Strickler (1979) larger prey were encountered, and captured less frequently. Handling time increases with size and natural defenses, i.e. spines of *Uca* zoea. Smaller first stage *C. sapidus* zoea with shorter spines are readily consumed by *C. sapidus* megalopae.

Diurnal Feeding Patterns

All zoeal stages fed at higher rates at night. Sulkin *et al.* (1979) demonstrated that swimming speeds of *C. sapidus* larvae followed a diurnal pattern with up to 60% increased swimming speeds at night. Based on the Gerritsen and Strickler (1979) model increased nighttime feeding can be explained by changes in swimming speed. Actual feeding rates for various concentrations of prey were equal to or less than predicted values. Lower observed rates may reflect prey handling time. Megalopae fed at higher rates during daylight hours when offered small prey (rotifers and *A. tonsa* nauplii). No difference in feeding rate was noted when large prey (*Artemia* nauplii) were offered. Calculation of Manly's (1974) B index for prey selection indicates that megalopae weakly select for *Artemia* nauplii during daylight hours. Selection for *Artemia* nauplii was enhanced at night. These data suggest that megalopae can consume small prey but rely more on visual prey identification than zoeal stages.

Literature Cited

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